AN AIRBAG ARRANGEMENT

THE PRESENT INVENTION relates to an air-bag arrangement, and more particularly relates to an air-bag arrangement intended to provide protection for the occupants of a motor vehicle in the event that a side impact should occur.

When a side impact occurs, from one side of the vehicle, the vehicle is given a very sudden acceleration. The effect is that, due to inertia, occupants of the vehicle tend to move towards the side of the vehicle where the impact occurs.

Typically a vehicle occupant is restrained by a three-point seat-belt. Typically a three-point seat-belt has a lap portion and a diagonal portion, the diagonal portion typically extending from a point adjacent the centre of the vehicle upwardly across the chest or torso of the occupant to a point on the adjacent "B"-Post of the vehicle for a front seat passenger and "C"-Post of the vehicle for a rear seat passenger.

In the case of a side impact for a vehicle occupant who is sitting adjacent the side of the vehicle where the impact occurs, the effect will be that the torso of the occupant will tend to move towards the side of the vehicle where the impact occurs. The shoulder of the occupant will thus be "caught" by the

diagonal strap and the occupant will be restrained. However, for a seat occupant sitting on the side of the vehicle furthest from the side impact, the torso of the occupant will tend to move away from the adjacent "B"-Post, and will not be restrained to any substantial extent by the diagonal strap. Thus injuries may arise.

The present invention seeks to provide an improved air-bag arrangement.

According to the present invention, there is provided an air-bag arrangement in a motor vehicle to provide protection for the occupant of at least one seat, the or each seat being associated with two air-bag units, one air-bag unit containing an air-bag to be deployed to occupy a space on the inboard side of the seat and the other air-bag unit containing an air-bag to be deployed to occupy a space on the outboard side of the seat, there being a sensor and control arrangement to sense a side impact and to determine which side of the vehicle has been impacted, and to generate actuation signals capable of actuating only the air-bag unit closest to the point of impact.

Preferably, the air-bag is configured to provide protection for the occupants of two said seats arranged adjacent one another, wherein the sensor and control arrangement is configured to generate actuation signals capable of actuating only the air-bag unit associated with the first seat closest to the point of impact, and only the air-bag unit of the second seat closest to the point of impact.

Preferably, at least one seat is provided with a sensor to sense an occupant in the seat, the sensor enabling actuation of the air-bag units

associated with that seat in response to the actuation signal from the sensor and control unit.

Advantageously, at least one air-bag unit for the or each seat is mounted in the back-rest of the seat.

Conveniently, said one unit in the or each seat is on the inboard side of the seat.

Preferably, both air-bag units associated with the or each seat are mounted in the back-rest of the seat.

Advantageously, at least one air-bag unit associated with the or each seat is mounted in an adjacent pillar of the motor vehicle.

Conveniently, the or each said seat is provided with a three-point safety-belt.

Preferably, the or each safety-belt is provided with a pretensioner.

Advantageously, the inboard side of the or each seat is associated with a support element, the support element being configured to extend inboard of the inflated inboard air-bag so as to provide lateral support to at least part of the inflated air-bag.

Conveniently, the support element is mounted in or on the same seat as the inboard air-bag that it supports.

Preferably, said support element is moveable upon actuation of the air-bag on the inboard side of the seat, from an initial position to an operative position, the airbag being configured to extend to an operative position, the support element being configured to extend inboard of the inflated air-bag when in said operative position.

Conveniently said support element is resiliently deformable and configured, when in said operative position, to yield under a force exerted thereon by the weight of an occupant of the seat in a crash, thereby absorbing energy.

Preferably said support element is configured to move from said initial position to said operative position in a generally forwards direction relative to said back-rest.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a diagrammatic view illustrating two adjacent occupants of a vehicle,

FIGURE 2 is a view of a first embodiment of the invention showing air-bag units mounted in adjacent seats in a motor vehicle,

FIGURE 3 is a view of a modified embodiment of the invention illustrating air-bag units mounted in the seats of the vehicle, and mounted in the vehicle itself, with the air-bags being shown in the inflated condition,

FIGURE 4 is a side view of one of the vehicle seats illustrated in Figure 2, illustrating a deployed air-bag with an associated element.

Referring initially to Figure 1 of the accompanying drawings, two occupants 1, 2 are illustrated seated in the front seats of a motor vehicle. The first occupant 1 is restrained by a three-point safety-belt 3 which includes a lap strap 4 and a diagonal chest or torso strap 5 which extends to an anchoring point, typically in the form of a pillar-loop adjuster, mounted on the adjacent B-Post 6 of the vehicle. Similarly the second occupant, 2 is restrained by a seat-belt 7 which includes a lap strap 8, and a diagonal strap 9 which extends across the chest or torso of the occupant to an anchoring point, again typically in the form of a pillar-loop adjuster, provided on opposite the "B"-Post 10 of the vehicle.

It is to be appreciated that if the vehicle is involved in a side impact, as indicated by the arrow I, which might be caused by another vehicle hitting the side of the vehicle in question adjacent the first occupant 1, the vehicle will be given a very substantial sideways acceleration. The effect will be that, due to inertia, the occupant 1 will tend to move towards the adjacent "B"-Post 6. The occupant 1 will be restrained by the diagonal belt portion 5. However, the second occupant 2 will also move towards the "B"-Post 6 adjacent the first occupant 1. The second occupant 2 will thus not be restrained effectively by his or her seat-belt.

Referring now to Figure 2, two vehicle seats 11, 12 are shown schematically. The seat 11 has a squab 13, a back-rest 14 and a head-rest 15. In the outboard side of the seat-back there is provided an air-bag unit 15. The air-bag unit 15 is such that, on deployment of the air-bag, the air-bag itself extends outwardly from the back-rest and forwardly so that the main part of the air-bag lies adjacent a chest or torso of the seat occupant. Air-bags of this type are known per se. Mounted on the inboard side of the seat is a second air-bag unit 16. Again this air-bag unit is equivalent to the air-bag unit 15.

The adjacent seat 12 is of a similar design having a squab 17, a back-rest (18) and a head-rest 19, and having two air-bag units 20, 21 of the type discussed above.

The seat 11 is for use by the driver of the vehicle, and the seat 12 is for use by a front seat passenger. The seat 12 is provided with a sensor 22 to sense whether the seat is occupied or not. An impact sensor and control unit 23 is provided to sense a side impact and to deploy the air-bags appropriately.

Referring now to Figure 3, a modified embodiment of the invention is illustrated. In this embodiment of the invention the outboard air-bag units 15 and 20 are not mounted in the back-rests of the appropriate seats, but instead are mounted in the adjacent "B"-Posts of the vehicle. In all other respects the embodiment of Figure 3 is the same as the embodiment of Figure 2. Referring to Figure 3, it is to be understood that the vehicle illustrated has been subjected to a side impact on the driver's side of the vehicle, adjacent the seat 11. The impact is indicated by the arrow I, as in Figure 1.

As a consequence of the sensed side impact, the sensor and control unit 23 has only deployed the air-bag on the outboard side of the driver's seat 11, that is to say the air-bag in the air-bag unit 15 and not the air-bag of the air-bag unit 16 on the inboard side of the driver's seat 11. This air-bag thus provides a protective cushion located between the driver of the vehicle and the impact.

As shown in Figure 3, the sensor 22 sensed that the seat 12 is occupied, and consequently has caused only the inboard air-bag unit 21, and not the outboard air-bag unit 20, to be actuated so that an air-bag is provided between the second seat occupant and the side of the vehicle where the impact is occurring. The occupant of the seat 12 will therefore be restrained from moving towards the "B"-Post 6 by means of the inflated air-bag from the air-bag unit 21 and, should any "rebound" occur will be restrained from moving towards the "B"-Post 10 by the three-point seat-belt 7 as shown in Figure 1.

It is therefore to be appreciated that not all of the air-bags are deployed during a side impact, but only the air-bag of each seat which is located between an occupant of the respective seat and the impact, i.e. those air-bags which act to protect the occupants of the vehicle from the impact.

It is to be understood that if the sensor 22 did not sense that the seat 12 was occupied, or only sensed that the seat was occupied by a child seat, then the air-bag unit 21 would not be actuated by the sensor and control unit 23.

Of course, if the impact had occurred in the opposite sense, that is to say on the side of the vehicle adjacent the seat 12, then the air-bag units 16 and 20 would be deployed, again assuming that both seats were occupied.

Whilst the invention has been described with reference to two specific embodiments, it is to be appreciated that many modifications may be effected. The air-bag units associated with each seat may take many different designs. Whilst reference has been made to air-bag units mounted in the seat back and air-bag units mounted in the adjacent "B"-Pillar, it is to be appreciated that one of the air-bag units could be in the form of an inflatable curtain. Such an inflatable curtain, when inflated, occupies space between a seat occupant and the adjacent side of the vehicle, but, most importantly, occupies space immediately adjacent the seat to provide protection for the occupant.

Whilst reference has been made to a sensor 22 for sensing whether the seat 12 is occupied or not, any form of sensor may be utilised. Figures 2 and 3 illustrate a sensor mounted in the squab of the seat. However, an optical sensor or some other remote sensor such as a radar sensor may be utilised.

In certain embodiments of the invention it has been found beneficial to pretension the safety-belt of the seat occupant who is seated furthest from the side impact. Thus, in a preferred embodiment of the invention, three-point seat-belts are provided. Figure 3 shows part of the three-point seat-belt 7 described primarily with reference to Figure 1, in phantom, showing how the seat-belt 7 is provided with a retractor unit 24. The retractor unit 24 incorporates a pretensioner. Thus, during an impact situation, the sensor and control unit 23 may actuate the pretensioner in the retractor 24, and also may actuate a pretensioner at a corresponding retractor provided for the seat-belt 3

associated with the seat 11. It may be preferable for both seat-belts to be pre-tensioned in a side impact situation, but it has been found most preferable and most important for the seat-belt of the seat remote from the point of impact to be pretensioned.

If a child seat is detected on the seat, the sensor and control unit 23 may, in a side impact, actuate the appropriate pretensioner, thus tensioning the safety-belt that is holding the child seat in position, whilst not actuating the relevant air-bag unit.

Figure 4 illustrates the vehicle seat 12 of Figures 2 and 3, with the inboard air-bag unit 21 having been actuated so that the air-bag 21A has been inflated.

As illustrated in Figure 4, the inboard air-bag unit 21 of the vehicle seat 12 is provided with a support element 25 which is shown in an actuated condition in which it extends forwardly from the back-rest 18, on the inboard side of the inflated air-bag 21A such that the air-bag 21A extends between the support element 25 and the thorax of the seat occupant 2. The support element 25, in this deployed condition, serves to provide lateral support to the inflated air-bag 21A so as to hold it in a position effective to provide lateral protection to the thorax of the seat occupant 2 in the event of a side impact. It has been found desirable to provide this support element 25 because otherwise, the deployed inboard air-bag 21 may not provide adequate support to the seat occupant 2 in the absence of any other vehicle structure, or an adjacent inflated air-bag.

The support element 25 is, as illustrated above, illustrated in Figure 4 in an operative, deployed position. However, prior to actuation of the air-bag 21A, the support element 25 adopts an initial position in which it is allocated substantially within the back-rest 18. Upon actuation of the air-bag 21A, the support element 25 is configured to move from its initial position within the back-rest 18 to the deployed position illustrated in Figure 4, for example in a generally forwards direction relative to the back-rest 18. In a preferred arrangement, the support element 25 is resiliently deformable and is configured, when in its deployed position, to yield under a force exerted on it under the weight of the occupant 2 of the seat 12 in a crash, so as to absorb energy.

Of course, it is to be appreciated that the other vehicle seat 11, is also preferably provided with a support element similar to that described above, in order to provide lateral support to the inboard air-bag of that seat.

It is also to be appreciated that the support element could take other convenient forms such as, for example, a frame extending forwardly from the backrest of the seat, or possibly as at least part of a forwardly extending arm rest. It is not essential for the support element to move forwardly and indeed the support element could be permanently secured in its operative position. It is further to be appreciated that the support element need not be mounted to the same seat as the inboard air-bag which it supports, but may be associated with the inboard air-bag by being mounted to the adjacent seat or part of the structure of the vehicle.

In the present Specification "comprises" means "includes or consists of" and "comprising" means "including or consisting of".

The features disclosed in the foregoing description, or the following Claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.